Abstract of the Disclosure

An apparatus and method for taking absorbance-based chemical measurements are described. In a specific embodiment, an indicator-based pCO_2 (partial pressure of CO_2) sensor displays sensor-to-sensor reproducibility and measurement stability. These qualities are achieved by: 1) renewing the sensing solution, 2) allowing the sensing solution to reach equilibrium with the analyte, and 3) calculating the response from a ratio of the indicator solution absorbances which are determined relative to a blank solution. Careful solution preparation, wavelength calibration, and stray light rejection also contribute to this calibration-free system. Three pCO_2 sensors were calibrated and each had response curves which were essentially identical within the uncertainty of the calibration. Long-term laboratory and field studies showed the response had no drift over extended periods (months). The theoretical response, determined from thermodynamic characterization of the indicator solution, also predicted the observed calibration-free performance.